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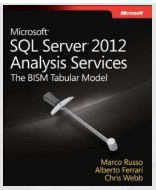
Time Intelligence in DAX

Who's that guy?



- BI Expert and Consultant
- Founder of www.sqlbi.com
  - Problem Solving
  - Complex Project Assistance
  - Data Warehouse Assessments and Development
  - Courses, Trainings and Workshops
- Book Writer
- Microsoft Business Intelligence Partner
- SSAS Maestros – MVP – MCP

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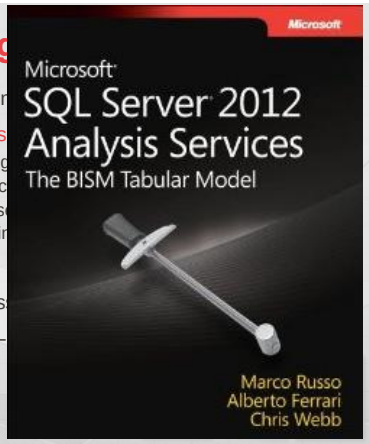

What is Time Intelligence?

- Many different topics in one name
  - Year To Date
  - Quarter To Date
  - Running Total
  - Same period previous year
  - Working days computation
  - Fiscal Year
- Well…seems to be anything related with time, handled in an intelligent way ☺

What do you need to know?

- Not really much
  - DAX basics
  - CALCULATE basics
- If not, add 100 to the session level
- Topic is DAX, we are going to use PowerPivot

Calendar Table

- First of all we need some data
- And a calendar table
  - Built in Excel
  - Or in a SQL Table
- Calendar table properties
  - All dates should be present
  - No holes
  - Otherwise time intelligence will not work

Year To Date: the easy way

TOTALYTD: life is easy

```
SalesAmountYTD :=

TOTALYTD(
    SUM (Sales[SalesAmount]),
    Calendar[FullDate]
)
```

Mark as Date Table

- In Tabular, use Mark as Date Table
- Set the column containing the date
- Needed to make time intelligence works
- Used by Power View as metadata information
- Many tables can be marked as date table

Set Sorting Options

- Month names do not sort alphabetically
  - April is not the first month of the year
- Use Sort By Column
- Set all sorting options in the proper way
- Beware of sorting granularity
  - 1:1 between names and sort keys

Use The Right Parameter

The parameter is the Date column in the Calendar Table
Not the SalesOrderHeader[OrderDate]
Otherwise, you get wrong results

```
LineTotalYTD :=

TOTALYTD(
    SUM (Sales[SalesAmount]),
    Sales[OrderDate]
)
```

Handling Fiscal Year

The last, optional, parameter is the end of the fiscal year
Default: 12-31 (or 31/12 - locale dependent)

```
SalesAmountYTD :=

TOTALYTD (
    SUM (Sales[SalesAmount]),
    Calendar[FullDate],
    "06-30"
)
```

Year To Date: the DAX way

- DATESYTD: Returns a set of dates, from the start of the year up to the parameter date
- CALCULATE: Creates a filter context and performs the SUM operation

```
SalesAmountYTD :=

CALCULATE (
    SUM (Sales[SalesAmount]),
    DATESYTD (Calendar[Date])
)
```

Running Total

- Running total, as most of the more complex time intelligence aggregations, needs the CALCULATE version, because there is no syntax sugaring here

```
SalesAmountRT :=

CALCULATE (
    SUM (Sales[Amount]),
    FILTER (
        ALL (Calendar),
        Calendar[FullDate] <= MAX (Calendar[FullDate])
    )
)
```

Same Period Last Year

Same period in previous year, CALCULATE is needed
Specialized version of DATEADD

No hierarchies, here, different technique when compared with Multidimensional

```
SalesSPLY :=

CALCULATE (
    SUM (Sales[SalesAmount]),
    SAMEPERIODLASTYEAR (Calendar[FullDate])
)
```

DATEADD

Similar to SAMEPERIODLASTYEAR, used to calculate different offsets

```
SalesAmountlSPLY :=

CALCULATE(
    SUM (Sales[SalesAmount]),
    DATEADD (Calendar[FullDate], -1, YEAR)
)
```

PARALLELPERIOD

Returns a FULL period of dates shifted in time

The whole period is returned, regardless dates in the first parameter, very useful to compute percentages

```
SalesPPLY :=

CALCULATE(
    SUM (Sales [LineTotal]),
    PARALLELPERIOD (Calendar[FullDate], -1, YEAR)
)
```

Period Table Approach

- Many Time Intelligence Aggregations
  - Many measures
  - User Experience might not be the best
- Tool Table (tool dimension in UDM)
  - Reduces the number of measures
  - Base measures can be hidden
- Drawbacks
  - The code is harder to debug

Multiple Calendar Tables

- Calendar is often a role dimension
  - Many roles for a date
  - Many calendar tables
- How many calendar tables?
  - Use many, only if needed by the model
  - Try to use only one table
  - Many calendars leads to confusion
  - And issues when slicing
- Use proper naming convention

Counting Working Days

- How many working days in a date range?
  - Easily solved with Calendar table
  - Define a new column «WorkingDays»
  - Aggregate with SUM
- Handles any date range
- Works on any periods
- No separation between fact tables and dimensions in Tabular

Check Delayed Orders

- How many orders were delayed?
  - Easy: «ShipDate Greater Than DueDate»
- How many working days of delay?
  - New Calculated Column
  - WorkingDayNumber
    - Incremental value from the start of table
    - Delta can be computed as difference

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Handling DateTime

- If time is a useful information
- Separate Date from Time
  - Date part → Calendar Table
  - Time part → Time Table
- Reduces distinct values
- Makes analysis much easier

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Semi Additive Measures

- Additive Measure
  - SUM over all dimensions
- Non Additive Measure
  - Different function over all dimensions
  - Example: average of the sale price
- Semi Additive Measure
  - SUM over some dimensions
  - Different function over other dimensions
  - Time is the standard exception for aggregations
  - Examples
    - Warehouse stocking
    - Current account balance

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Current Account Balance

Name	Occupation	Country	Date	Quarter	Balance
Katie Jordan	Farmer	USA	1/1/2010	Q1/2010	1,687.50
Luis Bonifaz	IT Consultant	Argentina	1/1/2010	Q1/2010	1,470.00
Maurizio Macagno	IT Consultant	Italy	1/1/2010	Q1/2010	1,500.00
Katie Jordan	Farmer	USA	2/1/2010	Q1/2010	2,812.50
Luis Bonifaz	IT Consultant	Argentina	2/1/2010	Q1/2010	2,450.00
Maurizio Macagno	IT Consultant	Italy	2/1/2010	Q1/2010	2,500.00
Katie Jordan	Farmer	USA	3/1/2010	Q1/2010	3,937.50
Luis Bonifaz	IT Consultant	Argentina	3/1/2010	Q1/2010	3,430.00

Sum of Balance	Column Labels			
Row Labels	Katie Jordan	Luis Bonifaz	Maurizio Macagno	Grand Total
Q1/2010	8,437.50	7,350.00	7,500.00	23,287.50
1/1/2010	1,687.50	1,470.00	1,500.00	4,657.50
2/1/2010	2,812.50	2,450.00	2,500.00	7,762.50
3/1/2010	3,937.50	3,430.00	3,500.00	10,867.50
Q2/2010	6,975.00	6,076.00	6,200.00	19,251.00
4/1/2010	2,250.00	1,960.00	2,000.00	6,210.00
5/1/2010	2,025.00	1,764.00	1,800.00	5,589.00
6/1/2010	2,700.00	2,352.00	2,400.00	7,452.00
Q3/2010	11,475.00	9,996.00	10,200.00	31,671.00
7/1/2010	3,600.00	3,136.00	3,200.00	9,936.00
8/1/2010	5,062.50	4,410.00	4,500.00	13,972.50
9/1/2010	2,812.50	2,450.00	2,500.00	7,762.50
Q4/2010	6,862.50	5,978.00	6,100.00	18,940.50
10/1/2010	2,250.00	1,960.00	2,000.00	6,210.00
11/1/2010	2,081.25	1,813.00	1,850.00	5,744.25
12/1/2010	2,531.25	2,205.00	2,250.00	6,986.25
Grand Total	33,750.00	29,400.00	30,000.00	93,150.00

- Month level correct
- Quarter level wrong
- Year level wrong

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SemiAdditive Measures

CALCULATE: to set the filter
LASTDATE: to find the last child

```
LastBalance :=

CALCULATE (
    SUM (Balances[Balance]),
    LASTDATE (Date[Date])
)
```

Moving Annual Total

Moving window from the current date back one year

```
CALCULATE(
    SUM( SalesOrderDetail[LineTotal] ),
    DATESBETWEEN(
        OrderDate[Date],
        NEXTDAY(
            SAMEPERIODLASTYEAR(
                LASTDATE( OrderDate[Date] )
            )
        ),
        LASTDATE( OrderDate[Date] )
    )
)
```

Querying with Time Intelligence

Using SUMMARIZE on the fact table yiedls an error, because dates in the fact table usually contain holes

```
DEFINE
    MEASURE 'Internet Sales'[PY Sales] =
        CALCULATE(
            [Internet Total Sales],
            SAMEPERIODLASTYEAR( 'Date'[Date] )
        )

EVALUATE

SUMMARIZE(
    'Internet Sales',
    'Date'[Calendar Year],
    'Date'[Month],
    'Date'[Month Name],
    "Sales", [Internet Total Sales],
    "PY Sales", [PY Sales]
)
```

Querying with Time Intelligence

The solution is to use the calendar table as the primary one, changing the shape of the query.

```
DEFINE
    MEASURE 'Internet Sales'[PY Sales] =
        CALCULATE(
            [Internet Total Sales],
            SAMEPERIODLASTYEAR( 'Date'[Date] )
        )
EVALUATE
ADDCOLUMNS(
    FILTER(
        SUMMARIZE(
            'Date',
            'Date'[Calendar Year],
            'Date'[Month],
            'Date'[Month Name],
            "Sales", [Internet Total Sales]
        ),
        [Sales] <> 0
    ),
    "PY Sales", [PY Sales]
)
```

Conclusions

- Time Intelligence is pretty easy
  - Many built-in functions
  - Calendar table is very important
- Based on DAX formulas
  - Not no hierarchies
- Formulas are sometime complex
- But you can author very powerful calculations
- Thus… learn DAX ☺

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